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Indian Standard

IS 17191 (Part 1) : 2019

विद्युत पॉवरट्रेन वाहन

भाग 1 विद्युत ऊर्जा की खपत मापना

Electric Power Train Vehicles

Part 1 Measurement of Electrical Energy Consumption

ICS 43.120

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भारतीय मानक ब्यूरो
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Electric and Hybrid Vehicles Sectional Committee, TED 27

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Electric and Hybrid Vehicles Sectional Committee and approval of the Transport Engineering Division Council.

This standard prescribes the requirements for measurement of electrical energy consumption of electric vehicles. In the formulation of this standard considerable assistance has been drawn from:

AIS 039 (Rev 1) : 2015 Electric Power Train Vehicles — Measurement of Electrical Energy Consumption.

AIS 049 : 2016 Electric Power Train Vehicles — CMVR Type Approval for Electric Power Train Vehicles

Central Motor Vehicles Rules, 1989 (as amended from time to time)

Doc No. MoRTH/ TAP/ CMVR - 115/116 (issue no 4)

This standard incorporates corrigendum 1 issued to AIS 039 in Sept 2017.

Information in Annex A and B has been taken from Central Motor Vehicles Rules and Doc No. MoRTH/TAP/ CMVR - 115/116 (issue no 4) while information in Annex C has been taken from AIS 049. In case of any variance between the standard and Central Motor Vehicles Rules, 1989 (as amended from time to time), latter shall prevail.

Following document may be referred for latest update on statutory requirements related to battery operated vehicles.

Central Motor Vehicles Rules, 1989 (as amended from time to time)

The composition of the committee responsible for the formulation of this standard is given at Annex D.

In reporting the results of a test or analysis made in accordance with this standard, is to be rounded off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

ELECTRIC POWER TRAIN VEHICLES

PART 1 MEASUREMENT OF ELECTRICAL ENERGY CONSUMPTION

1 SCOPE

This standard (Part 1) specifies the method for measurement of electrical energy consumption expressed, in Wh/ km for L, M and N categories of electric power train vehicles.

2 REFERENCES

The following standard contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the edition indicated were valid. All standard are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below:

IS No.	*Title*
14272 : 2011	Automotive vehicles — Types — Terminology

3 DEFINITIONS

For the purpose of this standard the definitions given in IS 14272 shall apply in addition to the following.

3.1 Access Probe — A test probe simulating in a conventional manner a part of a person or a tool, or the like, held by a person to verify adequate clearance from hazardous part.

3.2 Active Driving Possible Mode — The vehicle mode when application of pressure to the accelerator pedal (or activation of an equivalent control) or release of the brake system will cause the electric power train to move the vehicle.

3.3 Type Approval of Electric Power Train Vehicle — The approval of a type of electric power train vehicle regarding construction and functional safety requirements specific to the use of electric energy.

3.4 Auxiliary Battery — The battery unit whose reserve of energy is used only for the auxiliary network supply.

3.5 Auxiliary Network — The assembly of auxiliary electric equipment with similar functions to the one used on vehicles equipped with an internal combustion engine.

3.6 Barrier — Means the part providing protection against direct contact to the live parts from any direction of access.

3.7 Cell — A single encased electrochemical unit containing one positive and one negative electrode, which exhibits a voltage differential across its two terminals.

3.8 Conductive Connection — The connection using connectors to an external power supply when the rechargeable energy storage system (REESS) is charged.

3.9 Coupling System for Charging the Rechargeable Energy Storage System (REESS) — The electrical circuit used for charging the REESS from an external electric power supply including the vehicle inlet.

3.10 Coupling System — All the parts used to connect the vehicle to an external electric power supply (alternative or direct current supply).

3.11 Chassis Connected to the Electric Circuit — a.c. and d.c. electric circuits galvanically connected to the electrical chassis.

3.12 Direct Contact — Contact of persons with the live parts.

3.13 Drive Direction Control Unit — A specific device physically actuated by the driver in order to select the drive direction (forward or backward), in which the vehicle will travel if the accelerator is actuated.

3.14 Drive Train — Specific components of power train, such as the traction motors, electronic control of the traction motor, the associated wiring harness and connectors.

3.15 Degree of Protection — The extent of protection provided by an enclosure against access to hazardous parts against ingress of solid foreign objects and/or against ingress of water and verified by standardized test methods.

3.16 Electrical Chassis — A set made of conductive parts electrically linked together, whose potential is taken as reference.

3.17 Electrical Circuit — An assembly of connected live parts which is designed to be electrically energized in normal operation.

3.18 Electronic Converter — A device capable of controlling and/ or converting electric power for electric propulsion.

3.19 Electric Energy Conversion System — A system that generates and provides electric energy for electric propulsion.

3.20 Enclosure — The part enclosing the internal units and providing protection against direct contact from any direction of access.

3.21 Exposed Conductive Part — The conductive part which can be touched under the provisions of the protection IPXXB, and which becomes electrically energized under isolation failure conditions. This includes parts under a cover that can be removed without using tools.

3.22 Electric Power Train — A system consisting of one or more electric energy storage devices (for example, a battery, electromechanical fly wheel or super capacitor), one or more electric power conditioning devices and one or more electric machines that convert stored electric energy to mechanical energy delivered at the wheels for propulsion of the vehicle.

3.23 External Electric Power Supply — An alternating current (a.c.) or direct current (d.c.) electric power supply outside of the vehicle.

3.24 High Voltage — The classification of an electric component or circuit, if its working voltage is > 60 V and ≤ 1500 V d.c. or > 30 V and ≤ 1 000 V a.c. root mean square (rms).

3.25 High Voltage Bus — The electrical circuit, including the coupling system for charging the REESS that operates on high voltage.

Where electrical circuits, that are galvanically connected to each other, are galvanically connected to the electrical chassis and the maximum voltage between any live part and the electrical chassis or any exposed conductive part is ≤ 30 V a.c. and ≤ 60 V d.c. only the components or parts of the electric circuit that operate on high voltage are classified as a high voltage bus.

3.26 Live Parts — The conductive part(s) intended to be electrically energized in normal use.

3.27 On-board Isolation Resistance Monitoring System — The device which monitors the isolation resistance between the high voltage buses and the electrical chassis.

3.28 Open Type Traction Battery — A liquid type battery requiring refilling with water and generating hydrogen gas released to the atmosphere.

3.29 Rechargeable Energy Storage System (REESS) — The rechargeable energy storage system that provides electric energy for electric propulsion. The REESS may include sub-system(s) together with the necessary ancillary systems for physical support, thermal management, electronic control and enclosures.

3.30 Sub-system — Any functional assembly of REESS components.

3.31 Type of REESS — Systems which do not differ significantly, in such essential aspects as:

a) The manufacturer's trade name or mark;
b) The chemistry, capacity and physical dimensions of its cells;
c) The number of cells, the mode of connection of the cells and the physical support of the cells;
d) The construction, materials and physical dimensions of the casing; and
e) The necessary ancillary devices for physical support, thermal management and electronic control.

3.32 Service Disconnect — The device for deactivation of the electrical circuit when conducting checks and services of the REESS, fuel cell stack, etc.

3.33 State of Charge (SOC) — The available electrical charge in a tested device expressed as a percentage of its rated capacity.

3.34 Solid Insulator — The insulating coating of wiring harnesses provided in order to cover and protect the live parts against direct contact from any direction of access; covers for insulating the live parts of connectors, and varnish or paint for the purpose of insulation.

3.35 Net Power — The power obtained on a test bench at the end of the crank shaft or its equivalent at the corresponding motor speed with the auxiliaries listed in Table 1 of AIS-041 (Rev.1) and determined under reference atmospheric condition.

3.36 Maximum 30 min Power — The maximum net power of an electric drive train at d.c. voltage, which a drive train can deliver over a period of 30 min as an average.

3.37 Standard Production Equipment — Equipment provided by the manufacturer for a particular application.

3.38 Electric Range — Distance that can be driven electrically on one fully charged REESS for vehicles powered by an electric power train only.

3.39 Hazardous Live Part — A live part, which, under certain conditions of external influences can give an electric shock (*see* IEC 536, at present Document 64 (CO) 196).

3.40 Hazardous Mechanical Part — Moving part, other than a smooth rotating shaft, that is hazardous to touch.

3.41 Hazardous Part — A part that is hazardous to approach or touch.

3.42 Indirect Contact — Contact of persons or livestock with exposed conductive parts.

3.43 IP Code — A coding system to indicate the degrees of protection provided by an enclosure against access to hazardous parts, ingress of solid foreign objects, ingress of water to give additional information in connection with such protection.

3.44 Live Parts — Conductive part(s) intended to be electrically energized, in normal use.

3.45 Luggage Compartment — The space in the vehicle for luggage accommodation, bounded by the roof, hood, floor, side walls, as well as, by the barrier and enclosure provided for protecting the power train from direct contact with live parts, being separated from the passenger.

3.46 Maximum Mass — The technically permissible maximum mass declared by the manufacturer. Also referred to as GVW.

3.47 Maximum Thirty Minute Power — The maximum net power at wheels of an electric vehicle drive train at appropriate rated voltage, which the vehicle drive train can deliver over a period of 30 min as an average.

3.48 Maximum Net Power — The power obtained at the wheels of electric vehicle when tested on chassis dynamometer or at motor shaft when measured at bench dynamometer at corresponding vehicle/motor speed at reference atmospheric conditions and full load on wheels of vehicle/motor.

3.49 Nominal Voltage — The root mean square (rms) value of the voltage specified by the manufacturer, for which the electrical circuit is designed and to which its characteristics are referred.

3.50 Object Probe — A test probe simulating a solid foreign object to verify the possibility of ingress into an enclosure.

3.51 Off-board Charger — An energy electronic converter used for charging REESS from an external power supply (mains network) and which is not the integral part of the vehicle.

3.52 On-board Charger — An energy electronic converter linked by construction to the vehicle and used for charging the traction REESS from an external electric power supply (mains network).

3.53 Opening — A gap or aperture in an enclosure, which exists or may be formed by the application of a test probe at the specified force.

3.54 Passenger Compartment — The space for occupant accommodation, bounded by the roof, floor, side walls, doors, window glass, front bulkhead and rear bulkhead, or rear gate, as well as by the barriers and enclosures provided for protecting the power train from direct contact with live parts.

3.55 Protection Degree — The protection provided by a barrier/ enclosure related to the contact with live parts by a test probe, such as a test finger (IPXXB) or a test wire (IPXXD).

3.56 Power Train — The system of energy storage device(s), energy converter(s) and transmission(s) that converts stored energy to mechanical energy delivered at the wheels for propulsion of the vehicle.

3.57 Pure Electric Vehicle — Vehicle powered by an electric power train only.

3.58 Reference Mass — It means:

a) Two wheeled vehicles: unladen mass increased by a figure of 75 kg;
b) Three wheeled vehicles, L7 and M1, M2 (with GVW up to 3 500 kg) category vehicles: unladen mass increased by a figure of 150 kg;
c) N category vehicles: unladen mass increased by a figure of 50 percent of the pay load; and
d) For M2 (with GVW above 3 500 kg) and M3 vehicles: unladen mass increased by 75 kg × 50 percent of seating capacity.

3.59 Unladen Mass — The mass of the vehicle in running order without driver, crew, passengers or load, but with the fuel tank full (if any), cooling liquid, service and traction batteries, oils, on board charger, portable charger, tools and spare wheel, whatever, is appropriate for the vehicle considered and if provided by the manufacturer of the vehicle.

3.60 Vehicle Type — It means electric power train vehicles, which do not differ in such essential aspects as dimensions, structure, shape and nature of constituting materials; installation of the power system components, REESS or REESS packs, tyres, unladen mass, nature and type of electric and electronic components.

It also means vehicles which do not differ in such essential aspects as:

a) Installation of the electric power train and the galvanically connected high voltage bus; and
b) Nature and type of electric power train and the galvanically connected high voltage components.

3.61 Working Voltage — The highest value of an electrical circuit voltage root mean square (rms), specified by the manufacturer, which may occur between any conductive parts in open circuit conditions or under normal operating condition. If the electrical circuit is divided by galvanic isolation, the working voltage is defined for each divided circuit, respectively.

4 VEHICLE PREPARATION PLANNING

4.1 Condition of the Vehicle

The vehicle tyres shall be inflated to the pressure specified by the vehicle manufacturer when tyres are at the ambient temperature. The lubricants for the mechanical moving parts shall conform to the specifications of the vehicle manufacturer. The lighting, light – signaling and auxiliary devices shall be off, except those required for testing and usual daytime operation of the vehicle.

4.2 All energy storage systems available for other than traction purpose (electric, hydraulic, pneumatic, etc.) shall be charged up to their maximum level specified by the manufacturer.

4.3 If the rechargeable energy storage system (REESS) is operated above the ambient temperature, the operator shall follow the procedure recommended by the vehicle manufacturer in order to keep the temperature of the REESS in the normal operating range. The manufacturer's representative shall be in a position to attest that the thermal management system of the REESS is neither disabled nor reduced. The vehicle must have undergone at least 300 km during the seven days before the test with those REESS that are installed in the test vehicle. The seven days period can be waived on the request of vehicle manufacturer.

4.4 Operation Mode

All the tests are conducted at a temperature of between 20°C and 30°C.

NOTE — If the ambient condition cannot be met at the time of the test, then based on mutual agreement between test agency and vehicle manufacturer, requirement of ambient temperature condition can be waived.

The test method includes the four following steps:

a) Initial charge of the rechargeable energy storage system (REESS);
b) Application of 34 cycles of IDC (of 108 s duration each) for L category of vehicles (Pl *see* Annex A), or 22 cycles of Part 1 of MIDC (of 195 s duration each) for M1, M2 (with GVW upto 3500 kg) and N category of vehicles (*see* Annex B)

   Or

   25 Cycles of Delhi driving cycle for M2 (with GVW above 3 500 kg) and M3 category of vehicles (refer **6.1.1** or **6.1.2**) (*see* Annex C)
c) Charging the REESS;
d) Calculation of the electric energy consumption.

Between the steps, if the vehicle needs to be moved, it is pushed to the following test area (without regenerative recharging).

4.5 Initial charge of the Rechargeable Energy Storage System (REESS)

Charging the REESS consists of the following procedures.

NOTE — 'Initial charge of the REESS' applies to the first charge of the REESS, at the reception of the vehicle. In case of several combined tests or measurements, carried out consecutively, the first charge carried out shall be an 'initial charge of the REESS' and the following may be done in accordance with the 'normal overnight charge' procedure.

4.5.1 *Discharge of the Rechargeable Energy Storage System (REESS)*

The procedure starts with the discharge of the battery of the vehicle while driving (on the test track, on a chassis dynamometer etc.) at a steady speed of 70 percent ± 5 percent of the maximum thirty minutes speed of the vehicle. Stopping the discharge occurs:

a) When the vehicle is not able to run at 65 percent of the maximum thirty minutes speed;
b) When an indication to stop the vehicle is given to the driver by the standard on-board instrumentation; or
c) After covering the distance of 100 km.

4.5.2 *Application of a Normal Overnight Charge*

The Rechargeable Energy Storage System (REESS) shall be charged according to the following procedure.

4.5.2.1 *Normal overnight charge procedure*

The charge is carried out:

a) with the on-board charger, if fitted,
b) with an external charger recommended by the manufacturer using the charging pattern prescribed for normal charging, and
c) in an ambient temperature comprised between 20°C and 30°C.

The procedure excludes all type of special charges that could be automatically or manually initiated like, for instance, the equalization charges or the servicing charges. The vehicle manufacturer shall declare that during the test, a special charge procedure has not occurred.

NOTE — If the ambient condition cannot be met at the time of the test, then based on mutual agreement between test agency and vehicle manufacturer requirement of ambient temperature condition can be waived.

4.5.2.2 *End of charge criteria*

The end of charge criteria corresponds to a charging time of 12 h except if a clear indication is given to the driver by the standard instrumentation that the REESS is not yet fully charged or as specified by the manufacturer. In this case:

The maximum time is =

$$\frac{3 \times \text{Claimed battery capacity}\left(\text{Wh}\right)}{\text{Mains power supply}\left(\text{W}\right)}$$

5 FULLY CHARGED RECHARGEABLE ENERGY STORAGE SYSTEM (REESS)

REESS having been charged according to overnight charge procedure until the end of charge criteria.

6 TEST PROCEDURE

6.1 Test Sequence

6.1.1 The driving cycle shall be the Indian Driving Cycle (IDC) as given in Annex A for all L category vehicles.

6.1.2 The driving cycle shall be Part I of the modified Indian driving cycle as given in Annex B for M1, M2 (with GVW up to 3 500 kg) and N category of vehicles. The driving cycle shall be Delhi driving cycle as given in Annex C, as amended and revised from time to time for M2 (with GVW above 3 500 kg) and M3 category of vehicles.

6.1.3 In cases where the vehicle does not reach the required acceleration during driving, the accelerator/ speed control shall remain fully activated until the reference curve has been reached again.

6.2 Power Setting of the Chassis Dynamometer

The procedure prescribed in the document MoRTH/ TAP/ CMVR – 115/ 116 (issue no 4) as amended from time to time shall be adopted.

6.3 Test Method

6.3.1 *Principle*

The test method described hereafter permits to measure the electric energy consumption expressed, in Wh/km, to be measured.

6.3.2 *Parameters, Units and Accuracy of Measurements*

Parameters	*Units*	*Accuracy*	*Resolution*
Time	s	± 0.1 s	0.1 s
Distance	m	± 0.1 Percent	1 m
Temperature	°C	± 1°C	1°C
Speed	Km/ h	± 1 Percent	0.2 km/ h
Mass	Kg	± 0.5 Percent	1 kg
Energy	Wh	± 0.5 Percent	0.3 Percent

Where accuracy is specified, in percent, it is the percent of the measured value.

6.4 Application of the Cycle and Measurement of the Distance

6.4.1 The end of charging to (plug off) is reported.

6.4.2 The chassis dynamometer shall be set as per the settings given in **6.2**. Starting within 4 h from to, 34 cycles of IDC (of 108 s duration each) or 22 cycles of Part 1 of MIDC (of 195 s duration each) or 25 cycle of Delhi driving cycle as applicable (refer **5.1.1** or **5.1.2** above) are run. At the end, the covered distance (D), in km is recorded.

6.4.3 *Charge of the Rechargeable Energy Storage System (REESS)*

The vehicle shall be connected to the mains within 30 min after the conclusion of the driving cycle. The vehicle shall be charged according to normal overnight charge procedure (refer **4.5.2.1** above). The energy measurement equipment, placed between the mains socket and the vehicle charger, measures the charge energy E delivered from the mains as well as its duration. Charging is stopped after 24 h from the previous end of charging time to.

NOTE — In case of any power disruptions during charging, the 24 h period shall be exceeded according to the disruption duration. The maximum total Power disruption of 30 min duration is allowed irrespective of the number of failures. Validity of the charge shall be discussed between the test agency and the vehicle manufacturer.

6.4.4 *Electric Energy Consumption Calculation*

Energy E, in Wh and charging time measurements shall be recorded in the test report. The electric energy consumption is defined by the formula:

$$C = \frac{E}{D}$$

Where,

C = Electric energy consumption, in Wh/km and rounded off to the nearest whole number;

E = Energy, in Wh ; and

D = Distance covered during the test, in km.

6.5 Interpretation of the Results

6.5.1 The electric energy consumption adopted as the type approved value, shall be the value declared by the manufacturer if the value measured during testing does not exceed the declared value by more than 4 percent. The measured value can be lower without any limitations.

6.5.2 If the measured value of energy consumption exceeds the manufacturer's declared value by more than 4 percent then another test shall be carried out on the same vehicle. When the average of the two test results does not exceed the manufacturer's declared value, by more than 4 percent then the value declared by the manufacturer shall be taken as the type approval value.

6.5.3 If the average still exceeds the declared value by more than 4 percent, a final test shall be run on the same vehicle. The average of the three tests shall be then taken as the type approval value.

6.5.4 *Test Results*

The result of the electric energy consumption shall be expressed, in Watt-hour per kilometer (Wh/km) rounded off to the nearest whole number.

ANNEX A

[*Clause* 4.4 (b)]

INDIA DRIVING CYCLE

Table 1 Breakdown of the Operating Cycle Used for the Test

Sl No. (1)	No. of Operation (2)	Acceleration (m/sec^2) (3)	Speed (km/h) (4)	Duration of Each Operation (s) (5)	Cumulative Time (s) (6)
1	Idling	-	-	16	16
2	Acceleration	0.65	0-14	6	22
3	Acceleration	0.56	14-22	4	26
4	Deceleration	-0.63	22-13	4	30
5	Steady speed	-	13	2	32
6	Acceleration	0.56	13-23	5	37
7	Acceleration	0.44	23-31	5	42
8	Deceleration	-0.56	31-25	3	45
9	Steady speed	-	25	4	49
10	Deceleration	-0.56	25-21	2	51
11	Acceleration	0.45	21-34	8	59
12	Acceleration	0.32	34-42	7	66
13	Deceleration	-0.46	42-37	3	69
14	Steady speed	-	37	7	76
15	Deceleration	-0.42	[1][37-34]	2	78
16	Acceleration	0.32	34-42	7	85
17	Deceleration	-0.46	42-27	9	94
18	Deceleration	-0.52	27-14	7	101
19	Deceleration	-0.56	14-00	7	108

ANNEX B

[*Clause* 4.4 (b)]

MODIFIED INDIAN DRIVING CYCLE

Table 2 Operating Cycle on the Chassis Dynamometer (Part 1)

No. of Operation	Operation	Phase	Acceleration (m/s^2)	Speed (km/h)	Duration of Each		Cumulative Time (s)	Gear to be used in the case of manual gear box
					Operation (s)	Phase (s)		
1	Idling	1			11	11	11	6sPM + 5sK$_1$ (*)
2	Acceleration	2	1.04	0 - 15	4	4	15	1
3	Steady Speed	3		15	8	8	23	1
4	Deceleration	4	-0.69	15-10	2	5	25	1
5	Deceleration, Clutch Disengaged	4	-0.92	10-0	3	5	28	K1 (*)
6	Idling	5			21	21	49	16$_S$PM + 5$_S$K$_1$ (*)
7	Acceleration	6	0.83	0-15	5	12	54	1
8	Gear Change	6			2	12	56	
9	Acceleration	6	0.94	15-32	5	12	61	2
10	Steady Speed	7		32	24	24	85	2
11	Deceleration	8	-0.75	32-10	8	11	93	2
12	Deceleration, Clutch disengaged	8	-0.92	10-0	3	11	96	K$_2$ (*)
13	Idling	9			21	21	117	16$_S$PM + 5$_S$K$_1$ (*)
14	Acceleration	10	1.04	0-15	5	26	122	1
15	Gear Change	10			2	26	124	
16	Acceleration	10	0.62	15-35	9	26	133	2
17	Gear Change	10			2	26	135	
18	Acceleration	10	0.52	35-50	8	26	143	3
19	Steady Speed	11		50	12	12	155	3
20	Deceleration	12	-0.52	50-35	8	8	163	3
21	Steady Speed	13		35	13	13	176	3
22	Gear Change	14			2	12	178	
23	Deceleration	14	-0.86	32-10	7	12	185	2
24	Deceleration, Clutch disengaged	14	-0.92	10-0	3	12	188	K$_2$ (*)
25	Idling	15			7	7	195	7$_S$ PM (*)

(*) PM = gearbox in neutral, clutch engaged.

K1, K2 = first or second gear engaged, clutch disengaged.

ANNEX C

[*Clause* 4.4]

DELHI DRIVING CYCLE FOR BUSES

Table 3 Phase Wise Operation and Duration of the Delhi Bus Driving Cycle (DBDC)

No. of Operation	Operation	Phase	Speed Km/h	Acceleration m/s^2	Duration of Operation, s	Cumulative time, s	Distance, m
1	Idling	1	0	0	20	20	0
2	Acceleration	2	0-10	0.46	6	26	10
3	Cruising	3	10	0	2	28	6
4	Acceleration	4	10-18	0.44	5	33	23
5	Cruising	5	18	0	2	35	10
6	Acceleration	6	18-25	0.39	5	40	31
7	Deceleration	7	25-15	-0.46	6	46	35
8	Acceleration	8	15-30	0.42	10	56	69
9	Cruising	9	30	0	2	58	17
10	Deceleration	10	30-0	-0.49	17	75	79
11	Idling	11	0	0	17	92	0
12	Acceleration	12	0-10	0.46	6	98	10
13	Cruising	13	10	0	2	100	6
14	Acceleration	14	10-18	0.44	5	105	23
15	Cruising	15	18	0	2	107	10
16	Acceleration	16	18-30	0.42	8	115	58
17	Cruising	17	30	0	2	117	17
18	Acceleration	18	30-40	0.31	9	126	71
19	Cruising	19	40	0	2	128	22
20	Acceleration	20	40-50	0.31	9	137	91
21	Deceleration	21	50-0	-0.48	29	166	219
						TOTAL	**837**

Total Distance = 837 m

Total Time = 166 s

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Electric and Hybrid Vehicles Sectional Committee, TED 27

Organization	*Representative(s)*
International Centre for Automotive Technology (ICAT), Gurgaon	Shri Dinesh Tyagi (***Chairman***)
Ashok Leyland Ltd, Chennai	Shri Ravi M. Shrimati Suchismita C. (*Alternate*)
Association of State Road Transport Undertakings, New Delhi	Shri R Chandrababu Shri Ullas Babu (*Alternate*)
Automotive Research Association of India, Pune	Shri Anand A. Deshpande Shrimati Ujjwala S. Karle (*Alternate*)
Automotive Component Manufacture Association, New Delhi	Shri Uday Harite Shrimati Seema Babal (*Alternate*)
Bajaj Auto Ltd, Pune	Shri Arvind V. Kumbhar Shri Satyanarayana Gupta Bolisetty (*Alternate*)
Bharat Electronics Limited, Pune	Dr Saptarshi Ghosh
Central Pollution Control Board, Delhi	Shri A. Sudhakar Shri Suneel Dave (*Alternate*)
Centre for Development of Advanced Computing, C-DAC , Thiruvananthapuram	Shri Renji V. Chako Shri Chandrasekar V. (*Alternate*)
Centre for Science and Environment, New Delhi	Shrimati Anumita Roy Shri Vivek (*Alternate*)
Future Hi-Tech Batteries limited, Mohali	Ms Gagandeep Kaur Shri Gurvinder Singh Harjara (*Alternate*)
General Motors Technical Centre India Pvt Ltd, Bangalore	Shri Muthukumar Natarajan Shri Rajendra Khile (*Alternate*)
Hero Motor Corp Ltd , Dharuhera	Shri Adish Aggarwal Shri Subrat Kumar Dash (*Alternate*)
Honda Cars R & D India (HGID), Gautam Budh Nagar	Shri Feroz ali Khan Shri Yoshihisa Hara (*Alternate*)
Indian Institute of Petroleum, Dehradun	Shri Robindro Lairenlakpam Shri Wittison Kamei (*Alternate*)
Indian Institute of Technology, Kanpur	Prof Avinash Kumar Aggarwal Shri Tarun Gupta (*Alternate*)
Indian Institute of Technology, New Delhi	Dr K. A. Subramanian
International Advanced Research Centre for Powder-Metallurgy and New Materials (ARCI),Chennai	Dr R. Gopalan Dr Raju Prakash (*Alternate*)
International Centre of Automotive Technology (ICAT), Gurgaon	Shri Vijayant Ahuja Shri Vikas Sadan (*Alternate*)
KPIT Technologies, Pune	Shri Chinmay Pandit Shri Vishwajit Joshi (*Alternate*)
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Organization	*Representative(s)*
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